

CHAPTER 14. UTILITY IMPACTS ANALYSIS

TABLE OF CONTENTS

14.1	SUMMARY	14-1
14.2	PURPOSE OF THE ANALYSIS	14-1
14.3	ASSUMPTIONS	14-2
14.4	METHODS	14-3
14.5	RESULTS	14-4
14.5.1	HFC-245fa Trial Standard Levels 2 and 3	14-4
14.5.2	Trial Standard Levels 1 and 4	14-5
14.5.3	Economic Growth Cases	14-5

TABLES

Table 14.1	Reference Case: Forecast	14-6
Table 14.2	Trial Standard Level 1 – Forecast	14-7
Table 14.3	Trial Standard Level 2 – Forecast	14-8
Table 14.4	Trial Standard Level 3 – Forecast	14-9
Table 14.5	Trial Standard Level 4 – Forecast	14-10
Table 14.6	Trial Standard Level 1 – Low Economic Growth Forecast	14-11
Table 14.7	Trial Standard Level 2 – Low Economic Growth Forecast	14-12
Table 14.8	Trial Standard Level 3 – Low Economic Growth Forecast	14-13
Table 14.9	Trial Standard Level 4 – Low Economic Growth Forecast	14-14
Table 14.10	Trial Standard Level 1 – High Economic Growth Forecast	14-15
Table 14.11	Trial Standard Level 2 – High Economic Growth Forecast	14-16
Table 14.12	Trial Standard Level 3 – High Economic Growth Forecast	14-17
Table 14.13	Trial Standard Level 4 – High Economic Growth Forecast	14-18

CHAPTER 14. UTILITY IMPACTS ANALYSIS

14.1 SUMMARY

The effects of proposed water heater energy-efficiency standards on the electricity and natural gas industries were analyzed using a variant of U.S. DOE/EIA's National Energy Modeling System (NEMS) called NEMS-BRS, together with some exogenous calculations.^a NEMS was used by DOE/EIA to produce the *Annual Energy Outlook 2000 (AEO2000)*¹ and NEMS-BRS is used to provide some key equivalent inputs to our standards analysis. Because electric utility restructuring is well underway, it is no longer valid to assume the traditional cost recovery regulation of utilities, which was the basis of previous utility impact analyses. Therefore, this utility analysis consists of a comparison between model results for a case comparable to the *AEO2000* Reference Case, as reported in the *AEO2000*, and policy cases incorporating each of the water heater trial standard levels. Because the policy standards effects are too small to be seen in the context of the whole natural gas and electricity sector, NEMS-BRS is not used directly. Rather, exploratory runs are conducted to estimate marginal effects, which are then used to calculate the small effects on utilities due to each proposed standard level. The reduced electricity demand from Trial Standard Levels 2 and 3 reduces generation from both coal and natural gas. Because natural gas is more frequently the marginal fuel, it is usually affected to a greater degree, particularly early in the forecast period. Later in the forecast, natural gas-fired generation actually increases in many cases, likely due to reduced residential natural gas demand. Other generation is only minimally affected by any of the trial standard levels. Trial Standard Levels 1 and 4 are unique in that they propose negative electricity savings. The significant natural gas savings in the residential sector that result from these standards are reflected in the power sector by an increase in natural gas-fired generation. Coal and other types of generation are reduced by about the same degree as in the other standard levels, although primarily as a result of fuel-switching as opposed to reduced electrical demand.

14.2 PURPOSE OF THE ANALYSIS

The purpose of this analysis is to assess the impact of each trial standard level on electric and natural gas utilities. The requirement that the effects of proposed standards on electric utilities be analyzed has a long history. Analysis of the effects of proposed standards on the electric utility industry has historically taken the form of estimated fuel savings and capital cost savings relative to the likely reduction in revenues implied by lower electricity sales. In the short term, ratepayers of traditional utilities gained because of reduced energy use at fixed prices, but any imbalance between utility revenue and costs disappeared in the long run as traditional regulation ensured that utilities would recover their costs. In a restructured industry, however, only transmission and

^a For more information on NEMS, please refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2000*, DOE/EIA-0581(2000), March 2000. DOE/EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because our analysis entails some minor code modifications and the model is run under policy scenarios that are variations on DOE/EIA assumptions, the name NEMS-BRS refers to the model as used here (BRS is DOE's Building Research and Standards office, under whose aegis this work has been performed).

distribution providers will be permitted to recoup costs, and energy prices are not rigid in the short run, so the basis of our analysis must change. Using the *AEO2000* assumptions regarding the spread of restructuring allows us to use NEMS-BRS to estimate the overall effect of standards on the industry.^a We assess the impact of standards on utilities by reporting several key industry parameters, notably energy sales, generation, and capacity.

No previous appliance standard-setting process has considered the natural gas utility industry, and coverage of natural gas here is modest. Analysis of the effects of standards on the natural gas sector is limited to the reporting of residential consumption of natural gas and the change in the contribution of natural gas to electric generation.

14.3 ASSUMPTIONS

NEMS-BRS has several advantages that have led to its adoption as the source for basic forecasting in the appliance energy-efficiency analyses. NEMS-BRS relies on a set of assumptions which are well known and fairly transparent due to the exposure and scrutiny each AEO receives. In addition, the comprehensiveness of NEMS-BRS permits the modeling of interactions among the various energy supply and demand sectors and the economy as a whole, so it produces a sophisticated picture of the effects of appliance standards. Perhaps most importantly, because it explicitly simulates the impact on the industry, NEMS-BRS provides an accurate estimation of marginal effects, which yield better indicators of actual effects than estimates based on industry-wide average values. We chose marginal rates over average rates because we wanted to show the effects of proposed standards as well as what might also be happening in the market according to the *AEO2000* Reference Case.

The utility analysis uses the assumptions of *AEO2000* and treats water heater efficiency standards as variations in policy. Because the implementation of standards reduces demand by less than 1% of total U.S. electricity generation in any given year, its effect cannot be detected directly by simulations. Therefore, simulation runs are done for larger reductions in demand, and results are interpolated between *AEO2000* and these runs. We assume that the effects measured are linear within the range of interpolation. This issue is discussed further below and in Appendix I.

Variations in some of these assumptions have also been explored through two scenarios that represent alternative futures based on the Low and High Economic Growth cases of *AEO2000*, demonstrating the effects of alternative growth assumptions on energy markets. The growth assumptions for each case are based on macroeconomic forecasts prepared by DRI/McGraw-Hill.² The *AEO2000* Reference Case assumes a moderate rate of economic growth, 2.2% a year from 1998 through 2020. The Low Economic Growth case is based on lower growth rates for population, labor force, and productivity, resulting in higher prices and interest rates and lower growth in industrial output. Economic output in the Low Growth case increases by 1.7% a year from 1998 through 2020. The High Economic Growth case incorporates higher growth rates for population, labor force, and

^a The DOE/EIA assumptions regarding restructuring are explained on page 11 and pages 20-23 of the *AEO2000*.

labor productivity, resulting in lower inflation and interest rates and an increased projected economic output of 2.6% a year. The energy savings that we used to model the Low and High Economic Growth cases varied by a minor amount from that which we used to model the standard levels in the Reference Case.^a

14.4 METHODS

NEMS is a large, multi-sectoral, partial equilibrium model of the U.S. energy sector that has been developed over several years by DOE/EIA, primarily for the purpose of preparing the *Annual Energy Outlook*. NEMS produces a widely recognized baseline forecast for the U.S. through 2020 and is in the public domain. The NEMS-BRS model used for appliance standards analysis is based on the *AE02000* version of NEMS with minor modifications.

The current time horizon of NEMS-BRS is 2020, yet other parts of the water heater energy-efficiency standards analysis extend to the year 2030. It is not feasible to extend the forecast period of NEMS-BRS for the purposes of this analysis nor does DOE/EIA have an approved method for extrapolation of many outputs beyond 2020. While it might seem reasonable in general to make simple linear extrapolations of results, in practice this is not advisable because outputs could be contradictory. For example, changes in the fuel mix implied by extrapolations of those outputs could be inconsistent with the extrapolation of marginal emissions factors. An analysis of various trends sufficiently detailed to guarantee consistency is beyond the scope of this work, and, in any case, would involve a great deal of uncertainty. Therefore, all extrapolations beyond 2020 are simple replications of year 2020 results (except for fuel prices; see below). While these may seem unreasonable in some instances, in this way results are guaranteed to be consistent. As with the *AE0* Reference Case in general, the implicit assumption is that the regulatory environment does not deviate from the current known situation during the extrapolation period. Only changes that have been announced with date-certain introduction are included in NEMS-BRS. To emphasize the extrapolated results wherever they appear, they are shaded in grey to distinguish them from actual NEMS-BRS results.

For fuel prices, we extrapolate to 2030 using the DOE/EIA approach for forecasting fuel prices for the U.S. Federal Energy Management Program (FEMP). To determine the regional price forecasts for petroleum products for the years 2020-2030, we use the projected average annual growth rate for the world oil price in combination with the refinery and distribution markups from 2020 onward. Similarly, natural gas prices are derived from the average annual growth rate over the years 1998 to 2020 in combination with regional price margins from the year 2020. Electricity prices are kept constant at 2020 levels because it is assumed that the transition to a restructured utility industry will be completed.

Policy runs are executed by reducing electricity, natural gas, LPG, and oil consumption in the NEMS-BRS Residential Demand Module. These energy reductions are applied to the water

^a Please see pages 38 and 49 of the *AE02000* for more details on growth assumptions.

heater end use and are divided among U.S. census divisions based on the prevalence of each fuel for water heating as determined by DOE/EIA's *Residential Energy Consumption Survey* (RECS).³ All residential fuels are considered simultaneously, and the load shape effects of improved water heater efficiency are replicated as well as possible.

As mentioned above, the magnitude of energy decrements that would be required for NEMS-BRS to produce stable results safely out of the range of numerical noise is larger than even the most rigorous efficiency standard under consideration. Therefore, we estimate results in the range of effects of the standard levels using interpolation. Reductions to the Residential Demand Module water heater load are implemented at sets of multipliers of each level. Actual changes in generation and capacity due to the standard are then derived from these outputs. A detailed description of the interpolation methodology is given in Appendix I.

14.5 RESULTS

Table 14.1 shows the results from a NEMS-BRS run comparable to the published *AEO2000* Reference Case, with results for the four trial standard levels presented in Tables 14.2 through 14.5. Each table shows forecasts using interpolated results as described in Section 14.4 for residential energy sales and total U.S. electric generation and installed capacity. Results are discussed in the following two sections. Generally, most standards result in similar effects on electric and natural gas utilities, although the magnitude of the effects varies according to the level of forecast energy savings. When electricity savings dominate, as in Trial Standard Levels 2 and 3, natural gas-fired generation is somewhat more affected than coal-fired generation, especially early in the forecast. This effect reflects the more load-following role of natural gas generation overall. When household natural gas savings are highly coupled with small or negative electric savings, as evidenced in Trial Standard Levels 1 and 4, significantly different effects on coal- and natural gas-fired generation in the power sector result: while coal-fired generation is reduced, natural gas actually realizes an increase in generation. This gain substantially offsets the drop in natural gas sales to the residential sector that result from the standard.

14.5.1 HFC-245fa Trial Standard Levels 2 and 3

For HFC-245fa Trial Standard Levels 2 and 3, residential energy sales fall compared to the *AEO2000* Reference Case. The decrease in sales is proportional to the amount of energy that the NES model predicts will be saved by each standard level, ranging from just under 0.4% (HFC-245fa Trial Standard Level 2) to just under 1.3% (HFC-245fa Trial Standard Level 3) of total residential electricity sales and up to 1.0% (HFC-245fa Trial Standard Level 3) of total residential natural gas sales in the peak savings year reported. For each standard level, total U.S. electric generation decreases relative to the *AEO2000* baseline, by just under 0.47% in the peak year of the maximum savings case (HFC-245fa Trial Standard Level 3) to 0.10% in the HFC-245fa Trial Standard Level 2. The natural gas contribution to electric generation rises by about 0.8% in the peak year of HFC-245fa Trial Standard Level 3. Total installed capacity is also reduced in each standard level scenario, by a maximum of nearly 0.4% (HFC-245fa Trial Standard Level 3).

The reduction in natural gas consumption in the household will, by and large, exceed the reduction in natural gas consumption at the power plant as a fraction of total projected natural gas savings. As an example, in the HFC-245fa Trial Standard Level 3, the reduction in natural gas consumed by the residential sector in 2010 represents about 36% of total natural gas savings (with the power sector contributing the remaining 64%). It is important to note that these savings, even at their highest level, are small compared to total power sector natural gas consumption, never exceeding 1.1% at any of the trial standard levels (and amounting to only 0.3% of total U.S. natural gas consumption). Furthermore, natural gas consumption in power generation is predicted by NEMS-BRS to more than double during the forecast period, reaching more than 9.4×10^{15} Btu (10.0 EJ) by 2020. Residential natural gas consumption is also projected by NEMS-BRS to increase over time, though not as dramatically as in other sectors.

14.5.2 Trial Standard Levels 1 and 4

Results from the HFC-245fa Trial Standard Levels 1 and 4 provide a significantly different scenario. Unlike the other proposed standard levels, residential electricity sales actually increase relative to the *AEO2000* Reference Case. Residential sector natural gas sales, however, do still decrease. In Standard Level 4, total residential electricity sales increase from 0.04% (Trial Standard Level 1) up to 1.5% in the maximum savings case (Trial Standard Level 4), while residential natural gas sales drop from 2.3% (Trial Standard Level 1) up to over 10.0% in 2020 for Trial Standard Level 4. As a result, natural gas prices fall and Trial Standard Level 4 produces a moderate fuel-switching in the power sector from coal to natural gas generation.

While total U.S. generation increases by 0.6% in 2020 in response to Trial Standard Level 4, the effect on the fuel mix is somewhat greater; natural gas-fired electric generation increases by 2.9% as coal-fired generation falls by 0.5%. Petroleum-fired generation also falls by about 4.6% and generation by renewables is down by less than 0.1%. The amount of natural gas generation added to the power sector in 2020, 0.36×10^{15} Btu (0.38 EJ), is about 57% of the amount of natural gas saved at the household level, 0.63×10^{15} Btu (0.67 EJ). The difference, 0.27×10^{15} Btu (0.28 EJ) is approximately 0.8% of total U.S. natural gas consumption, or 2.9% of total power sector natural gas consumption.

14.5.3 Economic Growth Cases

The results under the Low and High Economic Growth cases are presented for the four HFC-245fa trial standards levels in Tables 14.6 to 14.9 and 14.10 to 14.13, respectively. For the Low Economic Growth trial standard level cases, the savings have a slightly larger impact than in their corresponding Reference Cases, while the High Growth standard level cases result in a slightly lower impact for each of the reported industry parameters (i.e., energy consumption, generation, and capacity).

Table 14.1 Reference Case: Forecast

NEMS-BRS Results: AEO2000 Reference Case					
	2000	2005	2010	2015	2020
Residential Sector Energy Consumption¹					
Electricity sales (TWh) ²	1,185	1,281	1,379	1,464	1,553
Natural Gas (EJ)	5.32	5.51	5.76	5.96	6.18
Other (EJ)	1.97	1.91	1.84	1.78	1.74
Natural Gas (Quads)	5.04	5.22	5.46	5.65	5.86
Other (Quads) ³	1.87	1.81	1.74	1.69	1.65
Total U.S. Electric Generation⁴					
Coal ((TWh)	1,930	2,127	2,172	2,251	2,347
Natural Gas (TWh)	601	717	1,001	1,297	1,476
Petroleum (TWh)	90	68	54	47	44
Nuclear (TWh)	688	674	627	511	427
Renewables (TWh)	389	411	429	437	447
Total (TWh) ⁵	3,698	3,997	4,283	4,543	4,741
Installed Generating Capacity⁶					
Coal (GW)	315.3	310.6	310.7	315.8	326.0
Other Fossil (GW) ⁷	274.8	334.0	404.7	461.8	507.6
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0
Renewables (GW)	94.7	98.5	101.7	103.8	105.7
Total (GW) ⁸	782.3	836.5	901.2	948.8	996.3
¹ Comparable to Table A2 of <i>AEO2000</i> : Energy Consumption, Residential ² Comparable to Table A8 of <i>AEO2000</i> : Electricity Sales by Sector ³ Includes distillate fuel, residential fuel, kerosene, LPG, motor gasoline, coal and renewable energy ⁴ Comparable to Table A8 of <i>AEO2000</i> : Electric Generators and Cogenerators ⁵ Excludes "Other Gaseous Fuels" cogenerators and "Other" cogenerators ⁶ Comparable to Table A9 of <i>AEO2000</i> : Electric Generators' and Cogenerators' Capability ⁷ Includes "Other Gaseous Fuels" cogenerators ⁸ Excludes Pumped Storage and Fuel Cells					

Table 14.2 Trial Standard Level 1 – Forecast

NEMS-BRS Results						Difference from <i>AEO2000</i> Reference											
												Extrapolation					
						2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption																	
Electricity sales (TWh)						1,185	1,281	1,379	1,464	1,554	0.0	0.1	0.2	0.3	0.6	1.5	2.4
Natural Gas (EJ)						5.32	5.49	5.68	5.84	6.04	0.00	-0.02	-0.08	-0.12	-0.14	-0.17	-0.19
Other (EJ)						1.97	1.91	1.83	1.78	1.73	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)						5.04	5.20	5.39	5.54	5.72	0.00	-0.02	-0.07	-0.11	-0.14	-0.16	-0.18
Other (Quads)						1.87	1.81	1.74	1.68	1.64	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Total U.S. Electric Generation																	
Coal (TWh)						1,930	2,127	2,172	2,249	2,343	0.0	0.0	-0.5	-2.4	-3.6	-3.6	-3.6
Natural Gas (TWh)						601	717	1,003	1,302	1,482	0.0	0.1	1.9	4.5	6.3	6.3	6.3
Petroleum (TWh)						90	68	53	46	43	0.0	0.0	-0.6	-1.2	-0.9	-0.9	-0.9
Nuclear (TWh)						688	674	627	511	427	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)						389	411	429	437	447	0.0	0.0	-0.1	0.2	0.0	0.0	0.0
Total (TWh)						3,698	3,997	4,284	4,554	4,743	0.0	0.1	0.7	1.1	1.9	1.9	1.9
Installed Generating Capacity																	
Coal (GW)						315.3	310.6	310.7	315.7	325.6	0.0	0.0	0.0	-0.1	-0.4	-0.4	-0.4
Other Fossil (GW)						274.8	334.0	404.8	462.2	508.4	0.0	0.0	0.1	0.4	0.8	0.8	0.8
Nuclear (GW)						97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)						94.7	98.5	101.7	103.8	105.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (GW)						782.3	836.5	901.3	949.1	996.7	0.0	0.0	0.1	0.3	0.4	0.4	0.4

Table 14.3 Trial Standard Level 2 – Forecast

NEMS-BRS Results						Difference from AEO2000 Reference								
											Extrapolation			
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030		
Residential Sector Energy Consumption														
Electricity sales (TWh)	1,185	1,280	1,376	1,460	1,547	0.0	-0.7	-2.6	-4.5	-5.9	-6.4	-6.8		
Natural Gas (EJ)	5.32	5.49	5.68	5.83	6.03	0.00	-0.02	-0.08	-0.13	-0.15	-0.17	-0.20		
Other (EJ)	1.97	1.91	1.83	1.78	1.73	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01		
Natural Gas (Quads)	5.04	5.20	5.38	5.53	5.72	0.00	-0.02	-0.08	-0.12	-0.14	-0.16	-0.19		
Other (Quads)	1.87	1.81	1.74	1.68	1.64	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01		
Total U.S. Electric Generation														
Coal (TWh)	1,930	2,127	2,171	2,247	2,340	0.0	-0.3	-1.2	-3.9	-7.1	-7.1	-7.1		
Natural Gas (TWh)	601	717	1,001	1,298	1,478	0.0	-0.2	-0.4	0.7	2.0	2.0	2.0		
Petroleum (TWh)	90	68	53	46	43	0.0	-0.2	-0.8	-1.2	-0.9	-0.9	-0.9		
Nuclear (TWh)	688	674	627	511	427	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Renewables (TWh)	389	411	429	437	447	0.0	0.0	0.0	0.1	0.0	0.0	0.0		
Total (TWh)	3,698	3,996	4,281	4,539	4,735	0.0	-0.7	-2.5	-4.4	-6.0	-6.0	-6.0		
Installed Generating Capacity														
Coal (GW)	315.3	310.6	310.7	315.5	325.2	0.0	0.0	0.0	-0.3	-0.8	-0.8	-0.8		
Other Fossil (GW)	274.8	334.0	404.2	461.4	507.5	0.0	0.0	-0.5	-0.4	-0.1	-0.1	-0.1		
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Renewables (GW)	94.7	98.5	101.7	103.8	105.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total (GW)	782.3	836.5	900.7	948.1	995.4	0.0	0.0	-0.5	-0.7	-1.0	-1.0	-1.0		

Table 14.4 Trial Standard Level 3 – Forecast

NEMS-BRS Results						Difference from AEO2000 Reference									
												Extrapolation			
						2000	2005	2010	2015	2020	2000	2005	2010	2015	2020
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,185	1,279	1,371	1,450	1,533	0.0	-2.3	-8.3	-14.3	-19.6	-24.2	-28.7			
Natural Gas (EJ)	5.32	5.50	5.72	5.90	6.12	0.00	-0.01	-0.04	-0.06	-0.06	-0.06	-0.05			
Other (EJ)	1.97	1.91	1.83	1.78	1.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Natural Gas (Quads)	5.04	5.21	5.42	5.59	5.80	0.00	-0.01	-0.04	-0.06	-0.06	-0.05	-0.05			
Other (Quads)	1.87	1.81	1.74	1.69	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Total U.S. Electric Generation															
Coal (TWh)	1,930	2,126	2,170	2,245	2,337	0.0	-0.8	-2.1	-5.9	-9.8	-9.8	-9.8			
Natural Gas (TWh)	601	716	995	1,288	1,464	0.0	-1.2	-6.4	-9.3	-11.8	-11.8	-11.8			
Petroleum (TWh)	90	68	53	46	43	0.0	-0.5	-0.7	-1.1	-0.9	-0.9	-0.9			
Nuclear (TWh)	688	674	627	511	427	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	389	411	429	437	447	0.0	0.0	0.0	0.1	0.0	0.0	0.0			
Total (TWh)	3,698	3,995	4,274	4,527	4,719	0.0	-2.5	-9.2	-16.2	-22.5	-22.5	-22.5			
Installed Generating Capacity															
Coal (GW)	315.3	310.6	310.7	315.4	324.9	0.0	0.0	0.0	-0.4	-1.1	-1.1	-1.1			
Other Fossil (GW)	274.8	334.0	403.2	459.3	505.1	0.0	0.0	-1.5	-2.5	-2.5	-2.5	-2.5			
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.7	98.5	101.7	103.8	105.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Total (GW)	782.3	836.5	899.7	946.0	992.7	0.0	0.0	-1.5	-2.8	-3.6	-3.6	-3.6			

Table 14.5 Trial Standard Level 4 – Forecast

NEMS-BRS Results						Difference from <i>AEO2000</i> Reference									
													Extrapolation		
	2000	2005	2010	2015	2020		2000	2005	2010	2015	2020	2025	2030		
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,185	1,284	1,389	1,480	1,577	0.0	2.8	9.6	16.2	24.2	35.2	47.5			
Natural Gas (EJ)	5.32	5.42	5.42	5.42	5.52	0.00	-0.09	-0.34	-0.54	-0.67	-0.80	-0.95			
Other (EJ)	1.97	1.91	1.82	1.76	1.72	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.01			
Natural Gas (Quads)	5.04	5.13	5.14	5.14	5.23	0.00	-0.09	-0.32	-0.51	-0.63	-0.76	-0.90			
Other (Quads)	1.87	1.81	1.73	1.67	1.63	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.01			
Total U.S. Electric Generation															
Coal (TWh)	1,930	2,128	2,172	2,245	2,335	0.0	0.6	0.1	-6.0	-11.6	-11.6	-11.6			
Natural Gas (TWh)	601	719	1,014	1,326	1,519	0.0	2.2	13.4	29.1	43.0	43.0	43.0			
Petroleum (TWh)	90	68	52	44	42	0.0	0.2	-1.7	-3.3	-2.0	-2.0	-2.0			
Nuclear (TWh)	688	674	627	511	427	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	389	411	429	437	447	0.0	0.0	0.1	0.4	0.1	0.1	0.1			
Total (TWh)	3,698	4,000	4,295	4,563	4,770	0.0	3.0	12.0	20.2	29.5	29.5	29.5			
Installed Generating Capacity															
Coal (GW)	315.3	310.6	310.8	315.6	324.9	0.0	0.0	0.1	-0.2	-1.1	-1.1	-1.1			
Other Fossil (GW)	274.8	334.0	406.8	466.5	515.5	0.0	0.0	2.1	4.7	7.9	7.9	7.9			
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.7	98.5	101.7	103.8	105.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Total (GW)	782.3	836.5	903.4	953.4	1,003.1	0.0	0.0	2.2	4.6	6.8	6.8	6.8			

Table 14.6 Trial Standard Level 1 – Low Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AE02000</i> Reference									
													Extrapolation		
	2000	2005	2010	2015	2020		2000	2005	2010	2015	2020	2025	2030		
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,183	1,275	1,366	1,438	1,505	0.0	0.0	0.0	0.1	0.0	0.3	0.9	1.6		
Natural Gas (EJ)	5.32	5.49	5.63	5.76	5.91	0.00	-0.02	-0.07	-0.12	-0.14	-0.16	-0.18			
Other (EJ)	1.96	1.90	1.83	1.77	1.71	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01		
Natural Gas (Quads)	5.04	5.20	5.34	5.46	5.60	0.00	-0.02	-0.07	-0.11	-0.13	-0.15	-0.17			
Other (Quads)	1.86	1.80	1.74	1.67	1.62	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01		
Total U.S. Electric Generation															
Coal (TWh)	1,923	2,105	2,133	2,170	2,213	0.0	-0.1	-1.0	-1.6	-3.2	-3.2	-3.2	-3.2		
Natural Gas (TWh)	591	683	942	1,203	1,342	0.0	0.1	1.6	3.4	5.0	5.0	5.0	5.0		
Petroleum (TWh)	85	60	43	37	33	0.0	0.0	-0.4	-0.7	-0.6	-0.6	-0.6	-0.6		
Nuclear (TWh)	688	674	627	511	428	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Renewables (TWh)	388	409	425	433	441	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2		
Total (TWh)	3,675	3,931	4,169	4,355	4,457	0.0	0.1	0.2	0.9	0.9	0.9	0.9	0.9		
Installed Generating Capacity															
Coal (GW)	315.3	309.6	308.0	309.5	311.2	0.0	0.0	0.0	0.0	0.0	-0.2	-0.2	-0.2		
Other Fossil (GW)	275.0	325.3	389.1	435.1	473.0	0.0	0.0	0.1	0.2	0.4	0.4	0.4	0.4		
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Renewables (GW)	94.7	98.3	101.2	103.0	104.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total (GW)	782.5	826.6	882.4	914.9	945.6	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2		

Table 14.7 Trial Standard Level 2 – Low Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AEQ2000</i> Reference									
											Extrapolation				
						2000	2005	2010	2015	2020	2000	2005	2010	2015	2020
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,183	1,274	1,363	1,434	1,499	0.0	-0.7	-2.5	-4.5	-5.8	-6.3	-6.6			
Natural Gas (EJ)	5.32	5.49	5.63	5.75	5.90	0.00	-0.02	-0.08	-0.12	-0.14	-0.16	-0.18			
Other (EJ)	1.96	1.90	1.83	1.77	1.71	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01			
Natural Gas (Quads)	5.04	5.20	5.33	5.45	5.59	0.00	-0.02	-0.08	-0.12	-0.14	-0.15	-0.17			
Other (Quads)	1.86	1.80	1.74	1.67	1.62	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01			
Total U.S. Electric Generation															
Coal (TWh)	1,923	2,105	2,133	2,169	2,211	0.0	-0.3	-1.3	-2.7	-5.1	-5.1	-5.1			
Natural Gas (TWh)	591	683	939	1,200	1,337	0.0	-0.2	-0.9	-0.4	0.1	0.1	0.1			
Petroleum (TWh)	85	60	43	37	33	0.0	-0.2	-0.4	-0.7	-0.8	-0.8	-0.8			
Nuclear (TWh)	688	674	627	511	428	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	388	409	425	433	441	0.0	0.0	-0.1	-0.2	-0.4	-0.4	-0.4			
Total (TWh)	3,675	3,930	4,166	4,350	4,450	0.0	-0.7	-2.6	-4.0	-6.1	-6.1	-6.1			
Installed Generating Capacity															
Coal (GW)	315.3	309.6	308.0	309.4	311.1	0.0	0.0	0.0	-0.1	-0.3	-0.3	-0.3			
Other Fossil (GW)	275.0	325.3	388.5	434.3	471.9	0.0	0.0	-0.5	-0.6	-0.7	-0.7	-0.7			
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.7	98.3	101.2	103.0	104.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Total (GW)	782.5	826.6	881.8	914.1	944.3	0.0	0.0	-0.5	-0.7	-1.1	-1.1	-1.1			

Table 14.8 Trial Standard Level 3 – Low Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AEQ2000</i> Reference									
													Extrapolation		
	2000	2005	2010	2015	2020		2000	2005	2010	2015	2020	2025	2030		
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,183	1,273	1,358	1,425	1,487	0.0	-2.2	-7.8	-13.3	-18.1	-21.8	-25.3			
Natural Gas (EJ)	5.32	5.50	5.66	5.81	5.98	0.00	-0.01	-0.04	-0.06	-0.06	-0.06	-0.06			
Other (EJ)	1.96	1.90	1.83	1.77	1.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Natural Gas (Quads)	5.04	5.21	5.37	5.51	5.67	0.00	-0.01	-0.04	-0.06	-0.06	-0.06	-0.06			
Other (Quads)	1.86	1.80	1.74	1.68	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Total U.S. Electric Generation															
Coal (TWh)	1,923	2,104	2,132	2,168	2,209	0.0	-0.9	-2.5	-4.1	-7.0	-7.0	-7.0			
Natural Gas (TWh)	591	682	934	1,190	1,325	0.0	-1.1	-6.0	-9.9	-12.4	-12.4	-12.4			
Petroleum (TWh)	85	60	43	37	33	0.0	-0.4	-0.3	-0.8	-0.8	-0.8	-0.8			
Nuclear (TWh)	688	674	627	511	428	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	388	409	425	433	441	0.0	0.0	-0.1	-0.2	-0.5	-0.5	-0.5			
Total (TWh)	3,675	3,929	4,160	4,339	4,435	0.0	-2.4	-8.8	-14.9	-20.7	-20.7	-20.7			
Installed Generating Capacity															
Coal (GW)	315.3	309.6	308.0	309.3	311.0	0.0	0.0	0.0	-0.2	-0.4	-0.4	-0.4			
Other Fossil (GW)	275.0	325.3	387.4	432.4	469.6	0.0	0.0	-1.6	-2.5	-3.0	-3.0	-3.0			
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.7	98.3	101.2	103.0	104.3	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1			
Total (GW)	782.5	826.6	880.7	912.1	942.0	0.0	0.0	-1.6	-2.7	-3.4	-3.4	-3.4			

Table 14.9 Trial Standard Level 4 – Low Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AEQ2000</i> Reference									
											Extrapolation				
						2000	2005	2010	2015	2020	2000	2005	2010	2015	2020
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,183	1,277	1,374	1,452	1,525	0.0	2.5	8.3	13.5	19.8	28.1	37.3			
Natural Gas (EJ)	5.32	5.42	5.38	5.36	5.42	0.00	-0.09	-0.33	-0.52	-0.62	-0.73	-0.85			
Other (EJ)	1.96	1.90	1.82	1.75	1.70	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.02			
Natural Gas (Quads)	5.04	5.14	5.10	5.08	5.14	0.00	-0.08	-0.31	-0.49	-0.59	-0.70	-0.81			
Other (Quads)	1.86	1.80	1.73	1.66	1.61	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.02			
Total U.S. Electric Generation															
Coal (TWh)	1,923	2,106	2,133	2,169	2,207	0.0	0.6	-0.7	-3.2	-9.1	-9.1	-9.1			
Natural Gas (TWh)	591	685	953	1,224	1,373	0.0	1.9	12.6	24.0	35.9	35.9	35.9			
Petroleum (TWh)	85	60	42	36	32	0.0	0.2	-1.4	-2.3	-2.1	-2.1	-2.1			
Nuclear (TWh)	688	674	627	511	428	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	388	409	425	433	440	0.0	0.0	-0.1	-0.3	-1.0	-1.0	-1.0			
Total (TWh)	3,675	3,934	4,179	4,372	4,480	0.0	2.7	10.4	18.2	23.7	23.7	23.7			
Installed Generating Capacity															
Coal (GW)	315.3	309.6	308.1	309.6	311.1	0.0	0.0	0.1	0.1	-0.3	-0.3	-0.3			
Other Fossil (GW)	275.0	325.3	391.1	438.9	477.9	0.0	0.0	2.1	4.0	5.3	5.3	5.3			
Nuclear (GW)	97.5	93.4	84.1	67.4	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.7	98.3	101.2	102.9	104.3	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1			
Total (GW)	782.5	826.6	884.5	918.8	950.3	0.0	0.0	2.2	4.0	4.9	4.9	4.9			

Table 14.10 Trial Standard Level 1 – High Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AE02000</i> Reference									
													Extrapolation		
	2000	2005	2010	2015	2020		2000	2005	2010	2015	2020	2025	2030		
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,183	1,286	1,391	1,486	1,584	0.0	0.1	0.3	0.5	0.9	1.7	2.7			
Natural	5.32	5.49	5.70	5.90	6.10	0.00	-0.02	-0.08	-0.12	-0.15	-0.17	-0.20			
Other (EJ)	1.97	1.91	1.85	1.79	1.75	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01			
Natural Gas (Quads)	5.04	5.20	5.40	5.59	5.78	0.00	-0.02	-0.08	-0.12	-0.14	-0.17	-0.19			
Other (Quads)	1.87	1.81	1.76	1.69	1.66	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01			
Total U.S. Electric Generation															
Coal (TWh)	1,937	2,159	2,231	2,377	2,622	0.0	-0.2	-0.5	-2.1	-7.4	-7.4	-7.4			
Natural Gas (TWh)	615	762	1,074	1,377	1,489	0.0	0.2	1.9	4.4	11.2	11.2	11.2			
Petroleum (TWh)	95	83	75	64	66	0.0	-0.1	-0.8	-1.3	-1.6	-1.6	-1.6			
Nuclear (TWh)	688	674	627	510	440	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	389	414	435	446	459	0.0	0.1	-0.2	0.1	-0.3	-0.3	-0.3			
Total (TWh)	3,742	4,092	4,442	4,774	5,076	0.0	0.0	0.6	1.2	1.9	1.9	1.9			
Installed Generating Capacity															
Coal (GW)	315.3	311.2	315.4	330.9	361.2	0.0	0.0	0.0	0.0	0.0	-0.8	-0.8			
Other Fossil (GW)	274.8	340.1	428.0	491.9	530.2	0.0	0.0	0.1	0.2	1.0	1.0	1.0			
Nuclear (GW)	97.5	93.4	84.1	67.4	58.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.9	99.1	102.7	105.1	107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Total (GW)	782.5	843.8	930.2	995.2	1,057.5	0.0	0.0	0.1	0.1	0.1	0.1	0.1			

Table 14.11 Trial Standard Level 2 – High Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AE02000</i> Reference									
													Extrapolation		
	2000	2005	2010	2015	2020		2000	2005	2010	2015	2020	2025	2030		
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,183	1,285	1,388	1,482	1,577	0.0	-0.7	-2.5	-4.5	-5.9	-6.5	-6.8			
Natural Gas (EJ)	5.32	5.48	5.70	5.89	6.09	0.00	-0.02	-0.08	-0.13	-0.15	-0.18	-0.20			
Other (EJ)	1.97	1.91	1.85	1.79	1.76	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01			
Natural Gas (Quads)	5.04	5.20	5.40	5.59	5.77	0.00	-0.02	-0.08	-0.12	-0.15	-0.17	-0.19			
Other (Quads)	1.87	1.81	1.76	1.69	1.66	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01			
Total U.S. Electric Generation															
Coal (TWh)	1,937	2,159	2,229	2,374	2,616	0.0	-0.4	-1.6	-5.1	-13.4	-13.4	-13.4			
Natural Gas (TWh)	615	762	1,073	1,375	1,487	0.0	0.0	0.8	2.4	9.2	9.2	9.2			
Petroleum (TWh)	95	83	74	63	66	0.0	-0.2	-1.6	-1.7	-1.5	-1.5	-1.5			
Nuclear (TWh)	688	674	627	510	440	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	389	414	435	446	459	0.0	0.1	-0.1	-0.1	-0.2	-0.2	-0.2			
Total (TWh)	3,724	4,091	4,439	4,769	5,068	0.0	-0.6	-2.5	-4.5	-6.0	-6.0	-6.0			
Installed Generating Capacity															
Coal (GW)	315.3	311.2	315.4	330.5	360.4	0.0	0.0	0.0	-0.4	-1.6	-1.6	-1.6			
Other Fossil (GW)	274.8	340.1	427.5	491.2	529.7	0.0	0.0	-0.4	-0.5	0.5	0.5	0.5			
Nuclear (GW)	97.5	93.4	84.1	67.4	58.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.9	99.1	102.7	105.1	107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Total (GW)	782.5	843.8	929.7	994.2	1,056.2	0.0	0.0	-0.4	-0.9	-1.2	-1.2	-1.2			

Table 14.12 Trial Standard Level 3 – High Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AE02000</i> Reference									
													Extrapolation		
	2000	2005	2010	2015	2020		2000	2005	2010	2015	2020	2025	2030		
Residential Sector Energy Consumption															
Electricity sales (TWh)	1,183	1,284	1,382	1,471	1,562	0.0	-2.5	-8.8	-15.0	-20.6	-25.2	-29.6			
Natural Gas (EJ)	5.32	5.50	5.74	5.96	6.19	0.00	-0.01	-0.04	-0.06	-0.06	-0.05	-0.05			
Other (EJ)	1.97	1.91	1.85	1.79	1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Natural Gas (Quads)	5.04	5.21	5.44	5.65	5.87	0.00	-0.01	-0.04	-0.06	-0.05	-0.05	-0.05			
Other (Quads)	1.87	1.81	1.76	1.70	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Total U.S. Electric Generation															
Coal (TWh)	1,937	2,158	2,228	2,370	2,608	0.0	-0.9	-2.9	-9.3	-21.5	-21.5	-21.5			
Natural Gas (TWh)	615	761	1,067	1,367	1,477	0.0	-1.2	-4.6	-6.2	-0.9	-0.9	-0.9			
Petroleum (TWh)	95	82	74	63	67	0.0	-0.5	-1.9	-1.6	-1.0	-1.0	-1.0			
Nuclear (TWh)	688	674	627	510	440	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (TWh)	389	414	435	446	459	0.0	0.1	-0.1	-0.1	-0.3	-0.3	-0.3			
Total (TWh)	3,724	4,089	4,432	4,756	5,050	0.0	-2.5	-9.5	-17.1	-23.7	-23.7	-23.7			
Installed Generating Capacity															
Coal (GW)	315.3	311.2	315.3	330.0	359.3	0.0	0.0	-0.1	-0.9	-2.7	-2.7	-2.7			
Other Fossil (GW)	274.8	340.1	426.5	489.3	527.8	0.0	0.0	-1.4	-2.4	-1.4	-1.4	-1.4			
Nuclear (GW)	97.5	93.4	84.1	67.4	58.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Renewables (GW)	94.9	99.1	102.7	105.1	107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Total (GW)	782.5	843.8	928.6	991.9	1,053.3	0.0	0.0	-1.5	-3.2	-4.1	-4.1	-4.1			

Table 14.13 Trial Standard Level 4 – High Economic Growth Forecast

NEMS-BRS Results						Difference from <i>AEO2000</i> Reference												
												Extrapolation						
Residential Sector Energy Consumption						2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030	
						Electricity sales (TWh)	1,183	1,289	1,402	1,505	1,611	0.0	3.2	11.3	18.8	27.9	39.4	52.0
						Natural Gas (EJ)	5.32	5.41	5.43	5.46	5.54	0.00	-0.10	-0.36	-0.57	-0.70	-0.84	-0.99
						Other (EJ)	1.97	1.91	1.84	1.77	1.74	0.00	0.00	-0.01	-0.02	-0.02	-0.01	-0.01
						Natural Gas (Quads)	5.04	5.13	5.14	5.17	5.26	0.00	-0.09	-0.34	-0.54	-0.66	-0.80	-0.94
Other (Quads)	1.87	1.81	1.75	1.68	1.65	0.00	0.00	-0.01	-0.02	-0.02	-0.01	-0.01						
Total U.S. Electric Generation																		
Coal (TWh)	1,937	2,159	2,231	2,376	2,614	0.0	0.1	0.1	-3.5	-14.6	-14.6	-14.6						
Natural Gas (TWh)	615	765	1,089	1,404	1,534	0.0	2.6	16.6	31.1	55.7	55.7	55.7						
Petroleum (TWh)	95	83	73	61	63	0.0	0.2	-2.6	-4.0	-5.5	-5.5	-5.5						
Nuclear (TWh)	688	674	627	510	440	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Renewables (TWh)	389	414	435	446	458	0.0	0.2	-0.1	0.0	-0.5	-0.5	-0.5						
Total (TWh)	3,724	4,095	4,455	4,797	5,109	0.0	3.1	13.9	23.7	35.2	35.2	35.2						
Installed Generating Capacity																		
Coal (GW)	315.3	311.2	315.5	331.0	360.7	0.0	0.0	0.1	0.1	-1.3	-1.3	-1.3						
Other Fossil (GW)	274.8	340.1	430.5	496.7	537.9	0.0	0.0	2.6	5.0	8.7	8.7	8.7						
Nuclear (GW)	97.5	93.4	84.1	67.4	58.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Renewables (GW)	94.9	99.1	102.7	105.1	107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Total (GW)	782.5	843.8	932.7	1,000.2	1,064.8	0.0	0.0	2.6	5.1	7.4	7.4	7.4						

REFERENCES

1. U.S. Department of Energy - Energy Information Administration, *Annual Energy Outlook 2000: With Projections Through 2020*, December, 1999. Washington, DC. Report No. DOE/EIA-0383(2000). <<http://www.eia.doe.gov/oiaf/aeo/>>
2. U.S. Department of Energy-Energy Information Administration, *Documentation of the DRI Model of the U.S. Economy*, December, 1993. Washington, DC. Report No. DOE/EIA-MO61.
3. U.S. Department of Energy - Energy Information Administration, *Residential Energy Consumption Survey: Household Energy Consumption and Expenditures 1997,1999*. <<http://www.eia.doe.gov/emeu/recs/recs97/publicusefiles.html>>